

WHAT IS CLAIMED IS:

1. A distance measuring method for measuring a distance from an imaging element to an object by optically taking in an image of the object to
5 image-form by said imaging element comprising the steps of:

making light from an object at a known distance from said imaging element pass through passing positions different from each other to project the light on an image forming plane of said imaging element, respectively;

- obtaining a displacement on the image forming plane between the
10 images projected through said different passing positions, said displacements being obtained by changing the distance from said imaging element to the object;

- pre-storing information showing the one-to-one correspondent relation between the obtained value of distance from said imaging element
15 to the object and said displacement;

making light from an object, of which a distance is to be measured, pass through said different passing positions to project the light on said image forming plane of said imaging element, respectively;

- detecting a displacement on the image forming plane between the
20 images projected through said different passing positions; and

obtaining a distance from said imaging element to said distance-measured object corresponding to said detected displacement from said information showing the one-to-one correspondent relation between the distance from said imaging element to the object and said displacement.

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2. A distance measuring method according to claim 1 comprising the steps of:

preparing a plurality of sets of said different passing positions, and pre-storing information showing the one-to-one correspondent relation between the obtained value of distance from said imaging element to the object and said displacement for each of said sets;

5 making light from an object, of which a distance is to be measured, pass through said plurality of sets of different passing positions to project the light on said image forming plane of said imaging element, respectively;

 detecting a displacement on the image forming plane between the images projected through each set of said different passing positions;

10 obtaining a distance from said imaging element to said distance-measured object corresponding to said detected displacement from said information showing the one-to-one correspondent relation between the value of distance from said imaging element to the object and said displacement for the corresponding set of the passing positions; and

15 obtaining a distance of said distance-measured object by statistically processing said distances individually for said sets.

3. A distance measuring method according to claim 2, wherein among said plurality of sets of passing positions, one of said passing positions in
20 each set is a position common to all said sets.

4. A distance measuring method according to claim 3, wherein said passing position common to all said sets is positioned on an optical axis at optically taking in the image of said object.

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5. A distance measuring method according to any one of claims 1, 2, 3 and 4 comprising the steps of:

performing passing of light through said different passing position at different timing for each of said passing positions;

storing the position of the image on the image forming plane; and

obtaining the displacement on the image forming plane of the light
5 passed through said different passing position using said stored position.

6. An image input apparatus having a distance measurement function, which comprises:

light passing position restricting means for restricting light so as to
10 pass through at least two different passing position;

a lens system for focusing the light passed through said light passing position restricting means;

image taking-in means for taking in an image from the light focused by said lens system; and

15 distance calculating means for calculating a distance from an imaging element to an object using the image by the light passed through said different passing position,

wherein said light passing position restricting means restricts light to pass through only a specified position.

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7. An image input apparatus having a distance measurement function according to claim 6, wherein said image taking-in means outputs an image taking-in start signal, and said light passing position restricting means executes restricting operation of a light passing position corresponding to the
25 output of said image taking-in start signal.

8. A distance measurement apparatus according to any one of claims

6 and 7, wherein said light passing position restricting means has a liquid crystal panel.

9. A distance measurement apparatus according to any one of claims 5 6 and 7, wherein said light passing position restricting means has a plurality of masks different in the opening position.

10. A distance measurement apparatus according to any one of claims 6 to 9, wherein in a case where said lens system is composed of a plurality 10 of lenses, said light passing position restricting means is arranged between the lenses of said lens system.

11. A distance measurement apparatus according to any one of claims 6 to 10, wherein said light passing position restricting means uses a plurality 15 of pinholes as the shape of the opening portion.

12. A distance measurement apparatus according to any one of claims 6 to 11, wherein said distance calculating means comprises:

means for making light from an object at a known distance from said 20 imaging element pass through passing positions different from each other to project the light on an image forming plane of said imaging element, respectively, and obtaining a displacement on the image forming plane between the images projected through said different passing positions, said displacements being obtained by changing the distance from said imaging 25 element to the object, and then storing information showing the one-to-one correspondent relation between the obtained value of distance from said imaging element to the object and said displacement;

means for making light from an object, of which a distance is to be measured, pass through said different passing positions to project the light on said image forming plane of said imaging element, respectively, and detecting a displacement on the image forming plane between the images projected through said different passing positions; and

means for obtaining a distance from said imaging element to said distance-measured object corresponding to said detected displacement from said information showing the one-to-one correspondent relation between the distance from said imaging element to the object and said displacement.

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13. An image input apparatus having a distance measurement function according to any one of claims 1 to 12, wherein the measured distance information and the image are output at a time.

15 14. A non-contact image input apparatus, said non-contact image input apparatus being an image input apparatus for optically reading a visually drawn image, which comprises:

a scanner for taking in the image by scanning an object to be read; and

20 a display or a printer for displaying the read result, wherein the image input apparatus described in claim 13 is used as said scanner.

15. A non-contact image input apparatus according to claim 14, which comprises means for expanding the image to a plane using the measured distance information.

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16. A non-contact image input apparatus according to claim 15, which comprises a switch or an interface for instructing whether or not operation of expanding the image to the plane is performed.